



## EPA 2010 Emissions and School Buses

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## Agenda

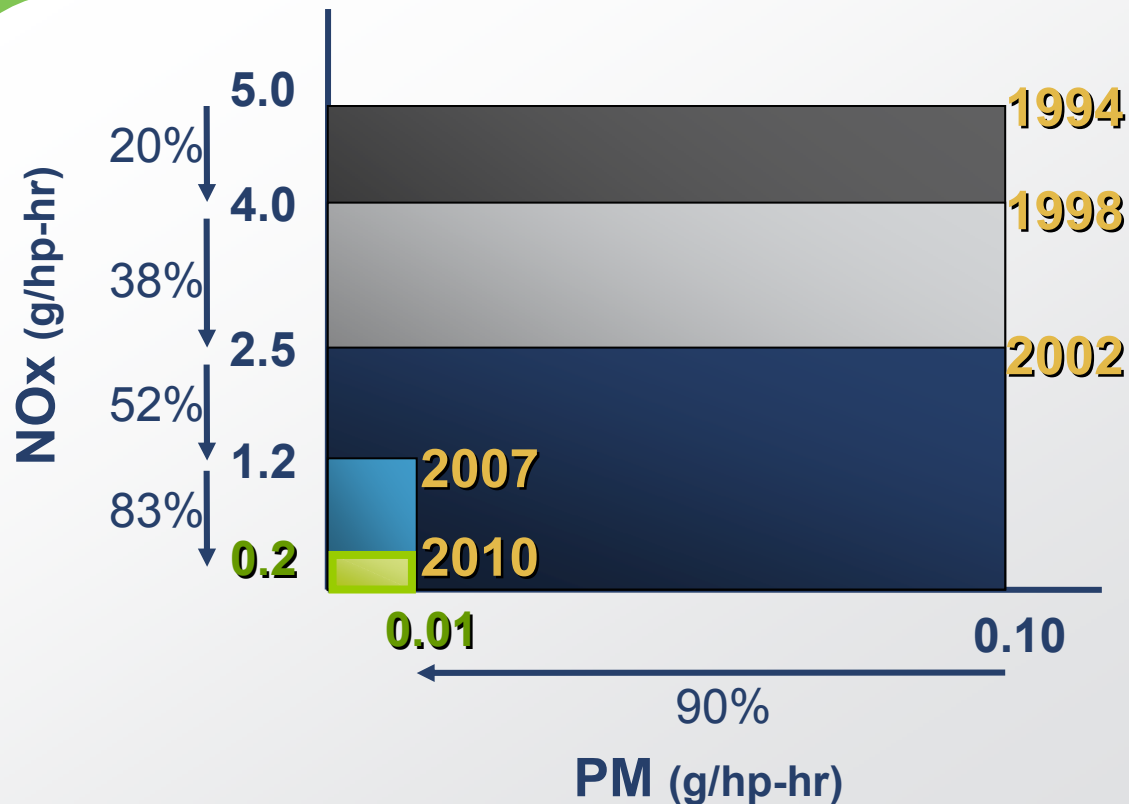
- 2010 Solutions Overview
- Why SCR is Simple
- Why SCR is Cost Effective
- Why SCR is Ready
- Facts About DEF





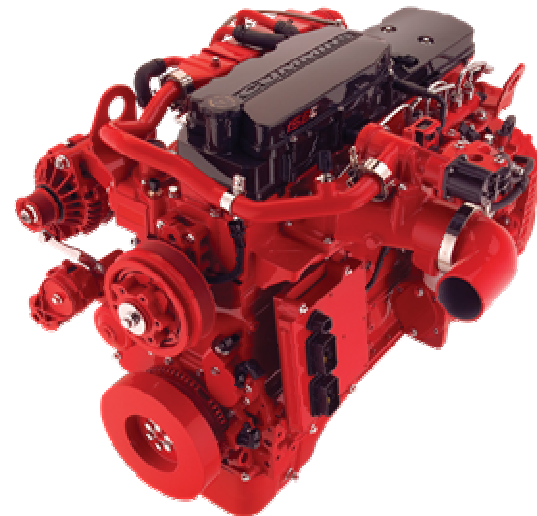
## US EPA Emissions History

✓ 2010 requires an 83% reduction in NO<sub>x</sub>—  
Oxides of Nitrogen—an exhaust element that contributes  
to acid rain, smog and greenhouse gas levels



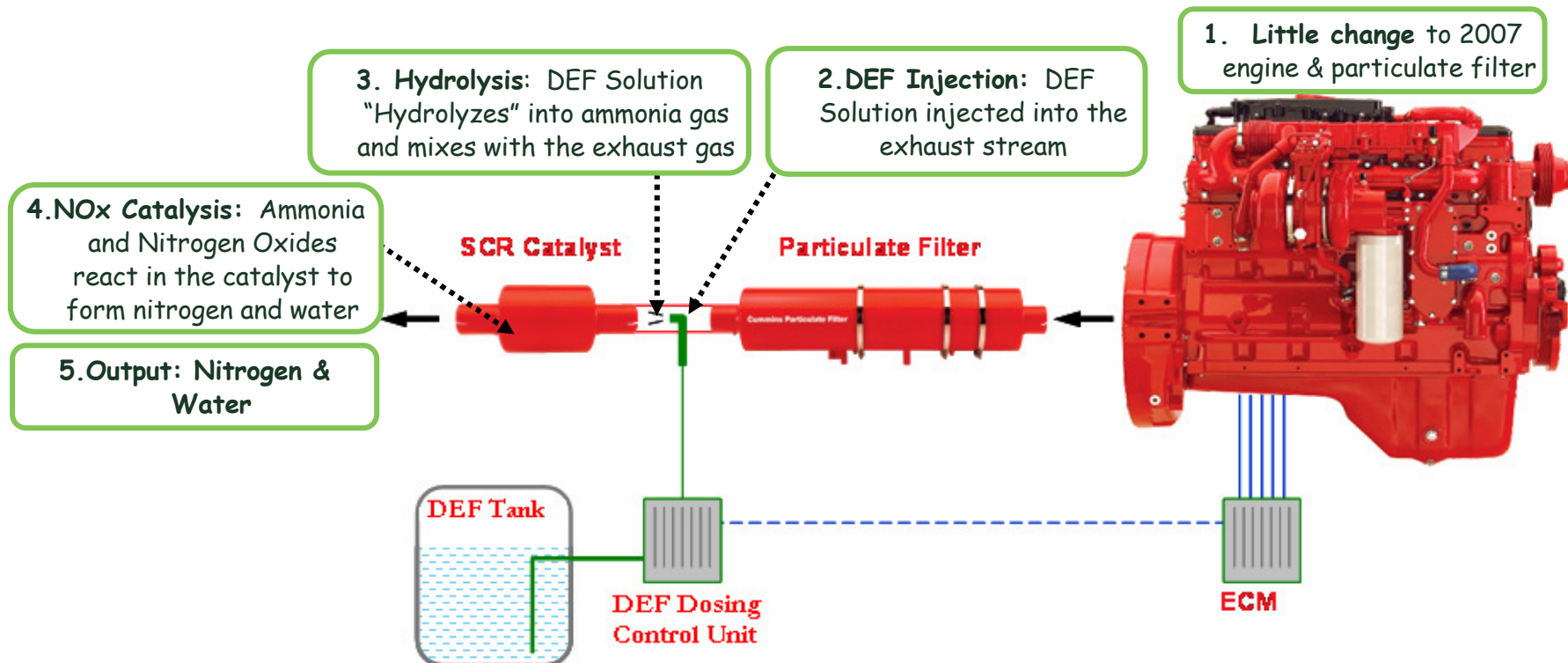
### Cummins ISB and ISC Features and Benefits

- Cummins base engine for 2010 will be same foundation as 2007 engine with additional reliability/durability improvements
- World class turbo that acts as exhaust break for reduced tire wear and increased brake life.
- Common rail fuel injection system for best in-class fuel economy and very low noise
- Integrated system from intake to exhaust for optimized system
- B50 life 500,000 miles



## SCR – Selective Catalytic Reduction

- ✓ A combination of EGR and SCR is used to reduce NO<sub>x</sub>
- ✓ SCR utilizes DEF, Diesel Exhaust Fluid, to treat the exhaust gases downstream of the engine, instead of requiring complex changes under the hood
- ✓ When the DEF reacts with the NO<sub>x</sub> in the SCR catalyst, nitrogen and water are formed and exit the tailpipe, two safe elements in the air we breathe





## Simple, Any Perspective You Take



### Technician's Perspective

- ✓ No complex changes to the engine
- ✓ SCR technology is reliable - Cummins testing found that Extreme EGR had a 20-25% engine life reduction due to condensation produced in the engine
- ✓ SCR hardware is designed to last a lifetime
- ✓ SCR requires lower number of regenerations
- ✓ Maintenance intervals don't change
- ✓ DEF filter replacement: 200,000 miles
- ✓ At approximately 4 fills per year, DEF refill fits into your maintenance schedule
- ✓ DEF is less toxic than other shop fluids, including windshield washer antifreeze fluid



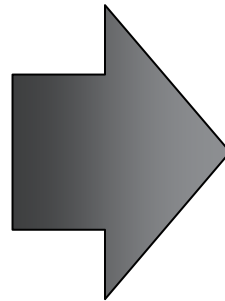
## Technician's Perspective: Hardware Add-on Vs. Engine Changes



### SCR Required Changes



- ECM & Emissions Controls
- DEF Tank
- Doser & Lines
- SCR Catalyst
- DEF Gauge

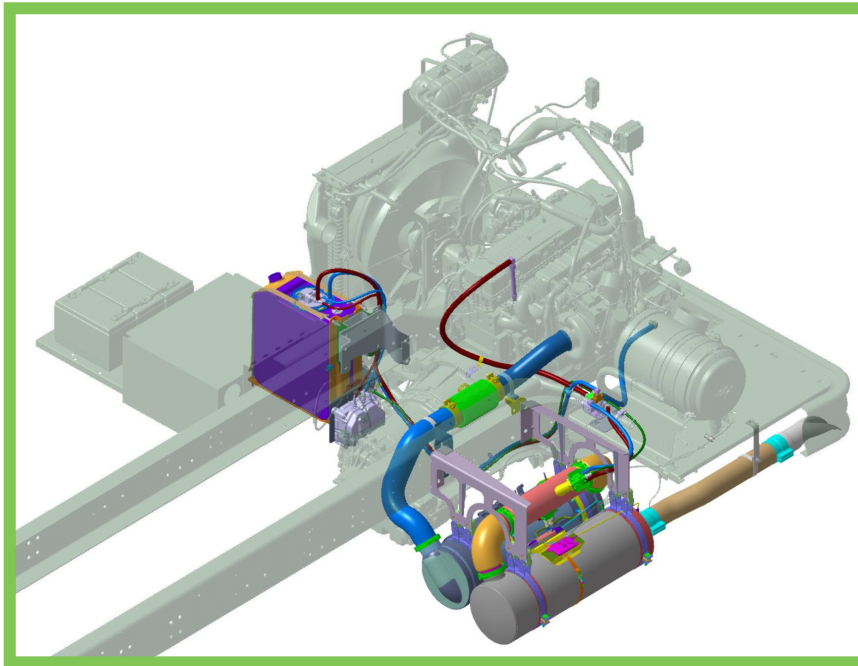


### Extreme EGR Required Changes

- ECM & Emissions Controls
- Injectors
- Vehicle Cooling
- Dual Turbochargers
- Dual Stage EGR Cooling
- Redesigned Pistons



## Drawings of SCR Hardware



Type D SCR System (HDX)

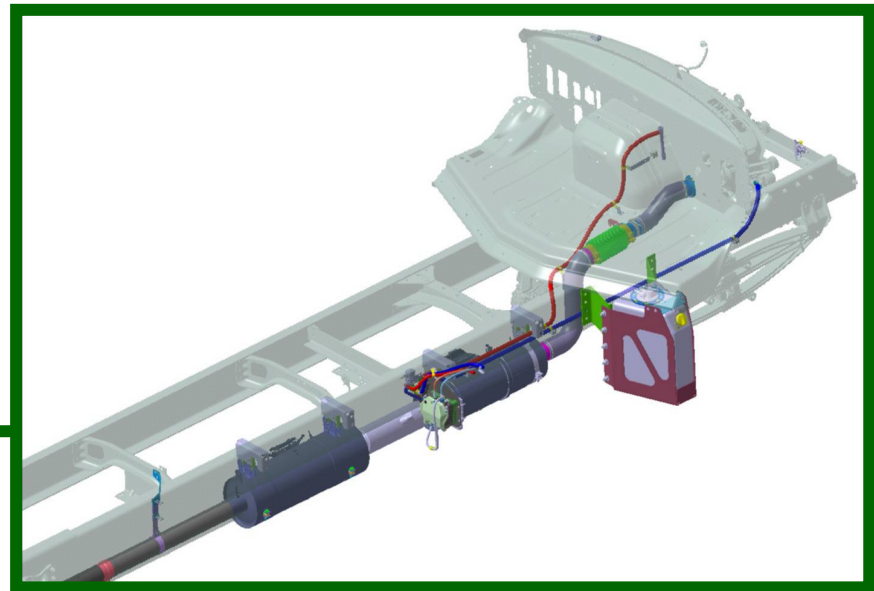


13 Gallon Tank



Type C SCR System (C2)

11 Gallon Tank





## Simple, Any Perspective You Take



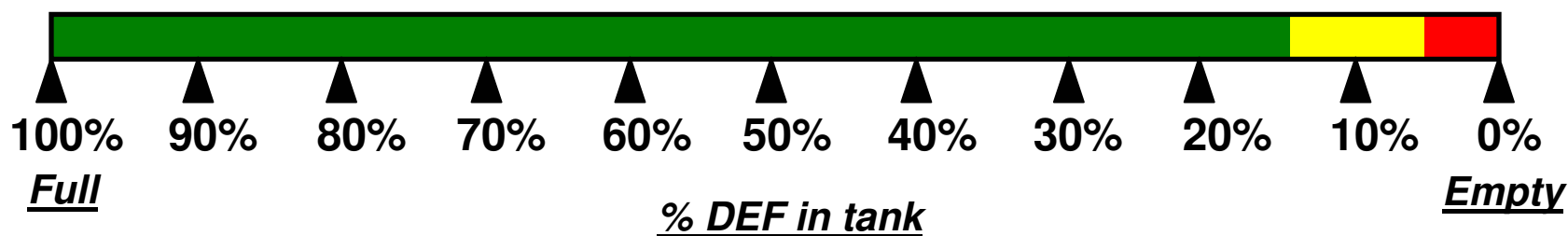
### Driver's Perspective

- ✓ Easy to read DEF gauge
- ✓ If DEF tank is empty, the engine will not shut down
- ✓ Empty tank will not cause the bus to shut down while driving. Five mph de-rate only occurs after bus has been turned off and restarted
- ✓ Leave DEF tank fill responsibility to maintenance schedules
- ✓ Still 450 miles to go when gauge warning turns yellow\*

\*estimated for Saf-T-Liner C2 11 gallon tank

## Driver's Perspective – Saf-T-Liner C2

% Full	Indicator Lamp
75% to 100%	4 green lights
50% to 75%	3 green lights
25 % to 50%	2 green lights
10% to 25%	1 green light



### SCR Pays You Back Over Life of the Bus

- ✓ SCR offers a 5-9% advantage vs. extreme EGR solutions
- ✓ Reliable & proven engine architecture
- ✓ Efficient combustion
- ✓ Fewer regenerations relative to extreme EGR
- ✓ Same maintenance intervals
- ✓ Less changes to moving parts such as injectors, pistons, turbochargers & cooling system



## We're Ready & Dependable Because...



Mainstream

Solution

- ✓ 90% of all on-highway engines sold in N. America chose SCR Technology

**DAIMLER**



**DETROIT DIESEL**



**VOLVO**

**PACCAR**

**ISUZU**



Proven

Technology

- ✓ Engine architecture is not changing
- ✓ Over 12 million Daimler SCR miles logged in N.A.
- ✓ Over 600,000 SCR vehicles operate in Europe from Scandinavia to the Mediterranean
- ✓ Over 245,000 Daimler and/or Cummins SCR vehicles operate in Europe
- ✓ SCR technology can reach EPA 2010 NO<sub>x</sub> requirements of .2g/hp-hr



# Facts About DEF

## DEF Fact Check

- ✓ DEF is non-toxic, biodegradable and non-flammable
- ✓ DEF is 32.5% UREA solution
- ✓ DEF freezes at 12° F
- ✓ Vehicle is fully operational when DEF is frozen
- ✓ DEF weighs 9.21 lbs per gallon
- ✓ DEF Shelf life is 12 -18 months
- ✓ Urea, a component of DEF is also used in skin softener, dish soap, tooth whitening formulas and pretzels
- ✓ System will operate in extreme temperatures

**[www.Factsaboutscr.com](http://www.Factsaboutscr.com)**



## Labels – Material Safety Data Sheets (MSDS)

### Diesel Exhaust Fluid (DEF)

Health:	1
Fire:	0
Reactivity:	0
Specific	

- Health – Exposure could cause irritation, but only minor residual injury even if no treatment is given
- Fire – Materials WILL NOT burn
- Reactivity – Normally stable, even under fire exposure conditions and are not reactive with water
- Specific – Rubber gloves suggested

### Windshield Washer Antifreeze Fluid

Health:	3
Fire:	3
Reactivity:	0
Specific	

- Health – Prolonged or repeated exposure by any route may cause systemic poisoning including varying degrees of temporary or permanent visual damage
- Fire – Auto ignition Temperature 385°F
- Reactivity – Normally stable, avoid heat, sparks, open flame
- Specific – Impervious clothing as needed where splashing can occur. Eyewash stations and safety showers



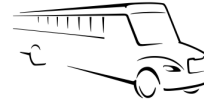
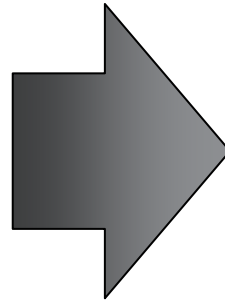


# SCR is the Right Choice for Pupil Transportation



## SCR Advantages

- Mainstream 2010 solution
- Engine operates under optimized combustion conditions
- Less heat rejection; Less particulate matter
- Proven & tested technology
- Cleaner tailpipe emissions
- Minimal engine changes



## Customer Benefits



- Improved fuel economy
- No horsepower loss with same displacement
- Less component stress
- Less regeneration needed for DPF cleaning
- Lower lifetime cost expected
- Reliability & durability